The Effects of Adaptive Yoga and Sports Programs on Psychological Wellbeing in Individuals with Disabilities

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This is to certify that I have examined this copy of a Plan B Project by

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and have found that it is complete and satisfactory in all respects, and that any and all revisions required by the final examining committee have been made.

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Introduction

An estimated 26% (61 million) of the population in the United States have a disability, inclusive of physical and mental health conditions that impair functioning (Okoro et al., 2016). Disabilities can be broadly defined as any impairment of the body or mind that limits an individual's abilities to participate and engage in certain activities (Centers for Disease Control and Prevention [CDC], 2019). Regarding different forms of disabilities, the Disability Statistics and Demographics Rehabilitation Research and Training Center estimates that 13-14% of people in the United States have a mobility disability, 10-11% have a cognitive disability, 7% have an independent living disability, and < 6% have other disabilities, such as sensory impairments or self-care disabilities (Houtenville & Boege, 2019; Okoro et al., 2016). While the term "disability" can be used to address a diverse array of needs, this study will use the term broadly in reference to individuals who have physical, intellectual, and/or developmental disabilities.

Evidence suggests that any disability may have an impact on an individual on psychological, physical, and social levels, which includes an individual's wellbeing, quality of life, and physical activity and fitness levels (Kosma et al., 2009; Rimmer et al., 1996; Wilson & Clayton, 2010). This is likely in part due to the high comorbidity with disabilities and mental health disorders (Scott et al., 2009). Other factors exist that are likely to impact psychological wellbeing in an individual with a disability. For example, statistically significant gaps in socioeconomic equity exist, revealing that more individuals with a disability live in institutional settings, do not receive a high school diploma, are unemployed, earn less income, and live in poverty than individuals without

a disability (Houtenville & Boege, 2019). Additionally, studies have found significantly higher rates of trauma within this marginalized group; for instance, there are increased rates of sexual assault in adults with disabilities compared to those without disabilities (13% compared to 5.7%, respectively; Sobsey & Mansell, 2011) as well as any other form of interpersonal trauma (4.0-11.4% compared to 2.8%; Petersilia 2001). Despite the impact that a disability may have on an individual, these populations remain underserved and often excluded from certain communities. Approximately a third of adults with disabilities do not have an established healthcare provider and have unmet healthcare needs due to cost, and about a quarter of adults with disabilities between the ages of 45 and 64 years had not had a routine check-up exam in the past year (CDC, 2019).

To offset some of the disparities that exist between adults with disabilities and those without, some public healthcare systems have partnered with community recreational programs to promote healthy living and build a more inclusive health and community program (CDC, 2019). Some of these programs promote physical activity and connection of the mind and body by offering adaptive physical exercise and yoga activities, with the goal to promote daily physical activity while simultaneously providing a space to connect socially. This study aims to examine overall psychological wellbeing in individuals with a disability by assessing a program that promotes physical activity and psychological wellbeing in adults with disabilities. Specifically, this study aims to assess the effects of adaptive yoga and sports programs on mindfulness, psychological wellbeing, and social connectedness in individuals with disabilities.

Adaptive Sports Programs

To increase physical activity and quality of life in individuals with disabilities, some adaptive physical exercise or sports programs have been implemented to increase levels of physical activity in this population. Although understudied within this population, there is a growing body of evidence suggesting physical activity and sports are advantageous across physical, mental, and even social domains, with increases in: self‑esteem, self‑perceived quality of life regarding family and social life, self‑efficacy, body image, empowerment, motivation for continued involvement, and overall health (Blauwet & Willick, 2012; Zabriskie et al., 2005). Studies have also found burgeoning evidence of significant differences in mood states, including reductions in tension, depression, and anger (e.g., Lundberg et al., 2011). Given the COVID-19 pandemic, one study assessed the feasibility of translating in-person adaptive sports programs into virtual programs, which found significantly higher increases in endurance, confidence, and self-esteem when participants engaged virtually compared to in-person prior to the COVID-19 pandemic lockdown (Blauwet et al., 2021). Of particular interest, one study found adaptive sports and recreation participation to provide individuals with the opportunity to build social connections, feel a sense of "normalcy," and compare themselves positively to those without disabilities (Lundberg et al., 2007).

Studies on adaptive sports programs are limited in amount and quality, and the studies that do exist have produced mixed results. Some outcomes (e.g., quality of life, life satisfaction, self-esteem) of sports programs in samples with disabilities show mixed findings in improvement that draw overall inconclusive results (for a review, see Bondár

et al., 2020), even within the same study. For example, one study found positive outcomes for individuals with limited mobility participating in adaptive sports (e.g., self-esteem, self-efficacy, sense of belonging, participation in meaningful activities), but participating in adaptive sports was also associated with negative outcomes on participants' social life (Côte-Leclerc et al., 2017). While evidence suggests that physical exercise and sports programs may have a positive impact on physical, mental, and social conditions, more evidence is needed to allow for procedural changes to appropriately direct funding towards empirically-based programs.

Adaptive Yoga Programs

Although some research on adaptive sports and recreation programs exist, there are limited offerings of yoga for those with disabilities and, thus, more limited research in this domain. However, yoga principles have potential benefits for individuals with disabilities. Due to high comorbidity of mental health conditions in individuals with disabilities, some have attempted to find physical movement programs that more directly address both mental and physical health conditions. Yoga is an alternative activity that more directly addresses mental and physical conditions through mind-body integration. In addition to the evidence supporting the use of sports and physical exercise with individuals with disabilities, mind-body activities like yoga may be equally or more beneficial than physical exercise programs to prevent and treat health conditions for people with limited mobility (e.g., chronic pain, Cramer et al., 2013; residential care settings, Saravanakumar et al., 2014). Yoga also has potential to translate to broader disabilities due to its emphasis on integration of mind and body.

Adaptive yoga refers to yoga for individuals with disabilities, in which cues are more relational and reference the "experience" of a pose and in which certain poses (standing, seated, inversions, restorative) are offered with modifications (Mind-Body Solutions, 2021). This form of yoga aims to facilitate yoga practices particularly among individuals living with disability, trauma, loss, and posttraumatic stress disorder and other mental illnesses across the lifespan. Because the term adaptive yoga is relatively new and developed within community settings (vs. academic or laboratory research settings), nearly no scholarly literature exists that uses the term. However, this form of yoga intends to be inclusive by considering the individual in their current state and by teaching universal elements of yoga that are accessible to all regardless of ability level (Mind-Body Solutions, 2021). Due to the nascent use of the term "adaptive yoga," finding empirical studies that explicitly studied individuals in adaptive yoga programs was limited. Therefore, it is important to note that the following evidence was compiled from studies that examined yoga programs specifically among individuals with disabilities, although the term "adaptive yoga" was not mentioned nor was it clear what adaptations were offered.

Studies that have assessed outcomes of yoga treatment for various forms of disabilities (e.g., stroke, multiple sclerosis, chronic pain, cerebral palsy, arthritis) have found yoga to be effective at increasing exercise capacity, balance, physical function, and health- and memory-related quality of life (Desveaux et al., 2015; Immink et al., 2014; Saravanakumar et al., 2014; Sharpe et al., 2016). Other findings suggest yoga may be an effective tool for reducing anxiety and depression symptoms, pain and stiffness, and

number of work days missed due to disability (Desveaux et al., 2015; Hartfiel et al., 2017; Sharpe et al., 2016). One study (Garrett et al., 2011), for example, used a biopsychosocial model to assess perceived outcomes in a 10-week yoga program for patients who had experienced a stroke; findings showed increased outcomes in physical and mental conditions, including increases in range of movement, walking ability, strength, calm feelings, and connection to and acceptance of the body.

With the current state of the literature on yoga as a mind-body treatment program still in its infancy, there are inconclusive findings on the effects of yoga among individuals with disabilities. Studies among individuals with disabilities have found mixed results of yoga on symptoms of depression, motor function, and general physical health when compared to a physical exercise program or a treatment as usual program (Chan et al., 2012; Desveaux et al., 2015; Immink et al., 2014; Veneri et al., 2018). These inconclusive findings among individuals with disabilities suggest a need for more research, as a plethora of studies exist demonstrating evidence for yoga and wellbeing among able-bodied individuals (for reviews, see e.g., depression, Cramer et al., 2017; posttraumatic stress disorder, Nguyen-Feng et al., 2019; motor functioning, Subramaniam & Bhatt, 2017; cardiovascular health, Posadzki et al., 2014).

Yoga and Wellbeing

As aforementioned, there are various outcomes that have been measured through the use of adaptive yoga programs. Psychological wellbeing is a broad and complex construct that is sometimes broken down into three factors: higher levels of life satisfaction, higher levels of positive affect, and lower levels of negative affect. Life

satisfaction is one of three factors that defines subjective wellbeing using a cognitive focus that is based on the evaluative beliefs or attitudes about one's life (Schimmack, 2008). Life satisfaction has been shown to increase after individuals participate in adaptive yoga and physical exercise programs (Pagan, 2020). As a result of physical exercise and yoga programs, evidence suggests that cognitive self-perceptions may also be impacted, with increased positive affect and decreased negative affect in individuals with physical disabilities (Giacobbi et al., 2006).

Mindfulness is another outcome that has been repeatedly examined with mind-body programs like yoga. Mindfulness-based programs have increased quality of life in individuals with intellectual disabilities (for a review, see Singh & Hwang, 2020). Another review found yoga programs to increase feelings of calmness and connection to and acceptance of the body (Garrett et al, 2011). Regarding potential dose-response relationships, a pilot study (Combs et al., 2018) assessed the effectiveness of a weekly yoga-based mindfulness group intervention in Veterans and active duty service members (N = 19) with a history of traumatic brain injury. Results suggested that attendance of sessions had a significant impact on perceived mindfulness, overall health and mood, and self-awareness. While these preliminary findings require further research, there is an indication that yoga interventions can have a positive impact on physical and mental impairments among individuals with disabilities, particularly in a community setting..

Thirdly, social connectedness appears to be a unique outcome because it emphasizes social outcomes rather than self outcomes. There has been little to no research that directly examines social connectedness as an outcome for adaptive yoga.

However, community programs are inherently community-based and therefore likely impact social connectedness. Related to this outcome, studies have found social quality of life and self-efficacy to increase after individuals participate in an adaptive yoga program (Veneri et al., 2018).

Present Study

The existing literature on both adaptive sports programs and adaptive yoga programs is still growing, and more research is needed, particularly in research that assesses outcomes within community programs and other field settings. Furthermore, physical exercise and sports programs have not been conceptualized as a mind-body exercise, although it requires a level of mind-body integration as well. Previous studies are limited by diverse ranges of disabilities, heterogeneity in treatment programs, low generalizability across disabilities, and a focus on specific aspects of disabilities. Additionally, studies have used measures with varying psychometric properties to assess outcomes of both sports and yoga programs. Few assessment tools exist that can feasibly measure outcomes in a community-based program that offers adaptive yoga and adaptive sports. More community-based participatory research with psychometrically-sound measures are needed to assess the effectiveness of yoga programs in field settings.

The present study is a community-based participatory research study that addresses these limitations by considering the integration of mind-body aspects associated with individuals with disabilities using adapted, reliable, and valid measures that address various aspects of psychological wellbeing (e.g., mindfulness, social

connectedness) and by assessing a program that currently exists in the community (vs. academic research setting). Specifically, the present study's research objectives were to:

1. Assess the feasibility of administering weekly assessments for people with disabilities in community-based adaptive yoga and sports programs. This was an exploratory research question.
2. Explore the effectiveness of adaptive yoga and adaptive sports programs in a community rehabilitation setting; specifically, examine the within-person effects of mindfulness (primary outcome), psychological wellbeing, social connectedness, and communicative participation (secondary outcomes) on individuals with a disability in a weekly adaptive yoga or adaptive physical exercise or sports programs. Among those for whom the present study is feasible, I hypothesized that mindfulness, psychological wellbeing, social connectedness, and communicative participation would increase over time.
3. Assess the mindfulness and psychological wellbeing effects of yoga as a form of mind-body exercise compared to a physical exercise or sports program as a mind-body activity. This was an exploratory research question on whether adaptive yoga or adaptive sports has a differential impact on the primary outcomes among individuals with a disability.

Method

Participants

Participants ($N = 29$) were 18 years of age or older and were part of a community health rehabilitation program organized through a rehabilitation institute in the

Arrowhead region of Minnesota, with headquarters in the Twin Cities area. Participants were not compensated for participation in this study, as the program evaluation was concurrent with their voluntary adaptive sports program participation; participants were able to elect not to participate in the program or the assessments at any time to maintain the collaborative and voluntary nature of community-based research.

Demographic information was collected by the community program regarding participants who participated in virtual programs during this time ($N = 37$). Based on these aggregate data, 67% of the participants identified as female ($n = 25$), and 33% identified as male ($n = 12$). Ages of clients ranged between ages 18 and 79, with 21% of clients between ages 20 and 29 ($n = 8$), 24% between ages 30 and 39 ($n = 9$), 16% between ages 40 and 49 ($n = 6$), 13% between ages 50 and 59 ($n = 5$), 16% between ages 60 and 69 ($n = 6$), and 5% between ages 70 and 79 ($n = 2$). Regarding primary disability diagnoses, 10.8% had a history of cerebrovascular accident (stroke; $n = 4$), 8.1% had multiple sclerosis ($n = 3$), 33% had cerebral palsy ($n = 12$), 5% had a developmental delay ($n = 2$), 2% had a history of traumatic brain injury ($n = 1$), 2% had spina bifida ($n = 1$), and 10.8% had a history of spinal cord injury ($n = 4$). Roughly 13.5% of participants had a history of seizures. Regarding mobility, 35.1% walked independently ($n = 13$), 18.9% walked with assistance ($n = 7$), 27% used a manual wheelchair ($n = 10$), and 8.1% used a power wheelchair ($n = 3$).

Measures

Constructs were chosen in collaboration with the rehabilitation institute. Scales were considered for inclusion if they had adequate psychometric properties, could be

administered in a short amount of time, and have been used with samples of individuals with varying disabilities. Only items that reflected a 6th grade or below reading level using the Flesch-Kincaid Grade Level were considered. Please see the Appendix for the measures.

Mindfulness

Mindfulness was the primary outcome variable measured. Mindfulness can be defined as awareness that is cultivated by paying attention to the present moment as non-reactively and non-judgmentally as possible (Kabat-Zinn, 1994). Based on previous research, the Five-Facet Mindfulness Questionnaire-24 (FFMQ-24; Bohlmeijer et al., 2011) was developed as a valid and reliable measure of mindfulness. The form comprises five facets designed to measure different elements of mindfulness: observing, describing, awareness, nonjudging, and nonreactivity. The FFMQ rates levels of mindfulness through items for each facet on a five-point Likert scale, in which 1 indicates "*never or very rarely true*" and 5 indicates "*very often or always true*." Sample questions for each facet are: observing: "I pay attention to physical experiences, such as the wind in my hair or the sun on my face"; describing: "I'm good at finding the words to describe my feelings"; awareness: "I find myself doing things without paying attention"; nonjudging: "I make judgments about whether my thoughts are good or bad"; and nonreactivity: "When I have distressing thoughts or images, I don't let myself get carried away by them."

The five facets were originally developed as a 39-item FFMQ (Baer et al., 2008, 2012) based on their factor loadings on each mindfulness facet. Gu et al. (2016) have evaluated the psychometric properties of the FFMQ-39 using confirmatory factor

analyses in a pretest-posttest design to assess mindfulness-based cognitive-behavioral therapy (MBCT) in a clinical sample. The results indicated that all factors except the observing facet fit the data (pre- and post-MBCT, respectively: observing, αs = .78, .82; describing, αs = .88, .90; awareness, αs = .84, .86; nonjudging, αs = .86, .88; nonreactivity, αs = .83, .85).

To reduce participant burden, short forms of the FFMQ were developed by past researchers based on psychometrics of the original. A 24-item FFMQ (Bohlmeijer et al., 2011) was developed to assess different aspects of mindfulness. This short form has been cross-validated using independent community and student samples, with a similar range of internal consistency scores to the 39-item FFMQ (observing, α = .78; describing, α = .91; awareness, α = .86; nonjudging, α = .86; nonreactivity, α = .73). Evidence of convergent and discriminant validity was found. However, in comparing intercorrelations, nonjudging did not correlate with observing or describing. Based on the consistent findings by Gu et al. (2016) and Bohlmeijer et al. (2011), the observing facet was omitted in the present study to further reduce participant burden and time constraints.

Overall, the FFMQ-24 appears to replicate the five-factor structure and correlates highly with the FFMQ-39. The FFMQ has been validated in samples with physical disabilities (e.g., osteoarthritis, musculoskeletal pain, multiple sclerosis, fibromyalgia; Lee et al., 2017; Rezaei & Hassazadeh, 2019; Schirda et al., 2015; Veehof et al., 2011). The top three factor loading items with the lowest reading level in each facet were used to ensure that individuals with cognitive disabilities would be able to understand the items. This approach follows conventions of selecting microlongitudinal assessment items (e.g.,

at least three items; Shrout & Lane, 2012). Items were tested for US grade reading level using the Readable app. This app uses the Flesh-Kincaid Grade Level (Linney, 2020) for reading level. Average reading level overall using three items from each facet was at grade 5.6, which indicates that students in fifth grade would typically be able to read and understand the items. The timeframe of the 12 items used was changed to "since you participated in the session." Pilot testing using a convenience sample (n = 6) was conducted by the present research team to assess the time it would take to complete the FFMQ-24 with one facet removed. Average administration time for all 24 items was 206.75 seconds (SD = 7.85 seconds). Further, negative valence items were reversed due to in-field pilot study comments regarding participant confusion around and adverse reactions to the negatively worded items. Therefore, a modified 12-item version of an FFMQ-SF was administered with an estimated time of 103.3 seconds (SD = 3.93 seconds).

Life Satisfaction

Wellbeing was a secondary outcome measured in the present study. Wellbeing is a complex construct that can be operationally defined in many ways. Life satisfaction is one of three factors that defines subjective wellbeing using a cognitive focus that is based on the evaluative beliefs or attitudes about one's life (Schimmack, 2008). Life satisfaction served as the core wellbeing measure in the present study and was operationalized with the Satisfaction with Life Scale (SWLS; Diener et al., 1985).

The SWLS was developed to assess a specific focus on life satisfaction, with evidence of internal consistency across items (average α = .78; Corrigan et al., 2013;

Vassar, 2008), test-retest reliability (Arrindell et al., 1991), and convergent and discriminant validity in a normative sample (Pavot & Diener, 2009). The SWLS is a five-item questionnaire that rates levels of satisfaction on a seven-point Likert scale (Corrigan et al., 2013), in which 1 indicates "*strongly disagree*" and 7 indicates "*strongly agree*." Sample items include "In most ways my life is close to my ideal" and "If I could live my life over, I would change almost nothing." The SWLS was chosen for this study because it has been used in samples with disabilities (e.g., Amtmann et al., 2019; Lucas-Carrasco, 2014), it can be administered in 1-2 minutes, and can be completed via interview, written, or online responses. The timeframe of the measure items was changed to "since I've participated in the session..." The five items on the SWLS were also measured for grade reading level using the Flesch-Kincaid Grade Level, with an average reading level of grade 3.4 (3rd grade).

Social Connectedness

Social connectedness was examined as another secondary construct to achieve a wider perspective of program effectiveness. Social connectedness can be defined as the experience of belonging and relatedness that is evaluated based on social appraisal and prominence within relationships (Van Bel et al., 2009). Social connectedness can be compared to belongingness in that they both measure relatedness. However, there is an important distinction between the two constructs. Social connectedness emphasizes the independent self in relation to others (Lee et al., 2001), whereas belongingness focuses more on affiliation to a group. Those who develop social connectedness are likely to have

higher resilience with vacillating relationships and higher respect for interpersonal differences between individuals (Baker & Baker, 1987).

The Social Connectedness Scale-Revised (SCS-R; Lee et al., 2001) was developed to measure the levels of social connectedness among students. The original SCS (Lee & Robbins, 1995) demonstrated high internal consistency and construct validity, but it was limited by a negatively skewed distribution. The SCS-R consists of a more normal distribution, with evidence of internal reliability and convergent and discriminant validity (Lee et al., 2001). The SCS is one of three scales with the strongest evidence for adequate psychometric properties in measuring similar constructs (Cordier et al., 2017) and has also been used in samples with physical disabilities (Hughes et al., 2004).

The SCS-R is a 20-item scale that rates levels of social connectedness on a six-point Likert scale, in which 1 indicates "*strongly disagree*" and 6 indicates "*strongly agree*." Ten items on the scale are positively worded, while the other ten items are negatively worded. The SCS-R is one of the only scales developed to measure social connectedness and has the highest validity and reliability among similar measures. Due to the need to reduce participant burden in this sample and pilot study feedback regarding difficult responses to the negatively-worded items, the three positively-worded, highest factor-loading items were administered. This approach follows the conventions of selecting microlongitudinal assessment items (e.g., at least three items; Shrout & Lane, 2012) and was deemed acceptable by the first author of the SCS-R (R. Lee, personal communication, February 26, 2020). These items were also modified to reflect past tense

to better fit the assessment of each session. Instructions were added to suggest to participants that items should be considered since they last participated in a session. Items for positively worded questions were: “I felt close to people,” “I was able to relate to my peers,” and “I was able to connect with other people.” When tested for reading level, the Flesch-Kincaid Grade Level found the six items used to be on a 3.2 (3rd) grade reading level.

Communicative Participation

As an additional construct to measure, particularly in light of the current COVID-19 pandemic, communicative participation was added as a secondary outcome to explore. Communicative participation can be defined as being involved in and participating in life situations in which knowledge, information, and ideas or feelings are shared (Eadie et al., 2006). Communicative participation was measured with the Communicative Participation Item Bank—General Short Form (CPIB-SF; Baylor et al., 2013). The CPIB-SF is a 10-item scale that rates levels of communicative participation on a four-point Likert scale, in which 3 indicates *“not at all”* and 0 indicates *“very much.”* In an effort to better fit the nature of our study, the items were reworded from “Does your condition interfere with…” to *“*Since you last participated in the last session, were you able to…” Examples of items used include “Since you last participated in the last session, were you able to… talk with people you know?” and “Since you last participated in the last session, were you able to… communicate when you need to say something quickly?”

The CPIB-SF was originally developed to provide a unidimensional self-report scale that measures the construct of communicative participation (Baylor et al., 2013). The original item bank showed good item fit and precise measurement, and the short form derived from the item bank was shown to match almost identically to the long form.

Qualitative Feedback

Qualitative feedback regarding participants' experiences in the program was assessed to identify significant content areas that may not have been addressed in the quantitative measures, especially given the exploratory aspects of the study. The qualitative portion of a structured feedback survey that was previously developed (Guarino et al., 2016) was adapted for use in this context. The survey was originally developed for a mobile intervention that was found to be feasible, acceptable, and preliminarily efficacious. The original survey's full qualitative portion consists of three open-ended items that ask participants for: (1) their general comments on the session, "What are your general comments on the session?"; (2) suggestions for improvement, "What are your suggestions for improvement, if any?"; and (3) "What additional content areas for the session would you want in the future, if any?" Due to time constraints and to reduce participant burden, the question regarding additional content areas was not administered in the present study. Furthermore, the survey administered in the present study differs from the original survey as it refers to an evaluation of "sessions" rather than "intervention" or "application."

Feasibility

Feasibility was assessed by examining survey completion in three manners: (a) maintenance of psychometric properties of the scales used inclusive of specific sample and adaptations; (b) a weekly dichotomous measure of whether or not the participant submitted a survey; and (c) the percentage of questions completed within each survey.

Procedures

During a typical year, the rehabilitation institute offers adaptive programs that vary by season and typically last 6-7 weeks. Adaptive programs offered include, but were not limited to: yoga, rock climbing, swimming, alpine skiing lessons, water skiing lessons, power soccer, dog sledding, archery, kayaking lessons, and fishing tournaments. Of these programs, adaptive yoga and several other adaptive fitness classes were offered online. Participants in this program typically come from Duluth, MN and surrounding areas. The adaptive yoga programs are offered each season for one 90-minute session a week for 6-7 weeks. Other adaptive sports programs vary in duration depending on the activity. Regarding the adaptive yoga intervention, all adaptive yoga instructors taught following principles of M. Sanford's Mind-Body Solutions (2021) adaptive yoga; all instructors completed the Mind-Body Solutions' teacher training program, a leading national certification body in adaptive yoga. Instructors received their Opening Yoga Instructor Certificate in addition to a 200-hour registered yoga teacher certification obtained from another certification body. Due to the COVID-19 global pandemic that occurred during the data collection of this study, nearly all data collected (96.5%) were from participants who engaged in virtual recreational and yoga sessions.

Assessments continued for five seasons of programming: summer 2020, fall 2020, winter 2021, and spring 2021. The program coordinator and/or instructors sent out emails with links to the electronic form of the assessments via Qualtrics to participants after each weekly session. To maintain the program evaluative nature of the present study, programming otherwise continued as usual, with no manipulation from the researchers. Close collaboration with the program director to develop the assessment survey and other study elements were maintained throughout the study to follow a community-based participatory research design and to check in on progress regarding the first research objective (assessing feasibility of creating and using an assessment tool in a community setting).

Instructors in the program were available remotely to help participants complete the questionnaires depending on the needs and mobility limitations of the participant. Due to the COVID-19 global pandemic restrictions, yoga instructors and volunteer assistants were not able to provide additional third-party ratings, as anticipated in the initial protocol. Therefore, assessment responses were collected directly from participant self-report. The data on the participants were collected weekly as long as they participated in the sessions. Further, the availability of third-party assistance was greatly reduced, as the community program no longer utilized volunteer assistants. Instructors were still present for each class, although they were extremely limited in number and taught on a virtual platform.

Power Analysis

Power analyses were conducted to determine the number of participants needed to find moderate-to-large significant outcomes. According to the National Institutes of Health-funded, web-based sample size software for designing clinical research (UCSF-CTSI, 2020; Hulley et al., 2013), 52 participants were needed (26 participants in each group) to achieve a large between-groups standardized effect size of $d = 0.80$ (two-tailed $\alpha = .05$, $\beta = .80$). To achieve a moderate standardized effect size of $d = 0.50$ (two-tailed $\alpha = .05$, $\beta = 0.80$), 126 participants were needed, with 63 participants in each group to compare across adaptive yoga and other adaptive sports programs, per Research Objective #3, which required the most statistical power.

Results

Preliminary Analyses

Due to COVID-19 restrictions and in-person programming shifting to virtual, we were unable to recruit our desired sample size for adequate statistical power. The final sample consisted of 29 participants who altogether completed 73 observations. Of the total sample, 60.4% ($n = 29$) of the sample completed the survey at their baseline timepoint, 27.1% ($n = 13$) completed the survey across two timepoints, and 12.5% ($n = 6$) completed the survey across three timepoints. All participants participated in adaptive yoga. The majority of participants (85.4%; $n = 22$) participated in yoga alone, while 14.6% ($n = 7$) participated in another sports or recreation program during the same week as yoga. These programs were: virtual adaptive cycling ($n = 1$), in-person adaptive kayaking ($n = 1$), virtual high intensity impact training ($n = 1$), virtual “Fired up Friday”

workout routine (n = 1), “Fitness: Move with me” workout routine (n = 1), and virtual whole body conditioning workout routine (n = 2).

Tests of normality were conducted following procedures from Kim (2013), in which the null hypothesis of normality is rejected if the absolute z-value for excess kurtosis or skewness > 3.29, with z-values calculated as the skew or kurtosis statistic over its respective standard error. All variables were deemed normally distributed except for the social connectedness variable, which resulted in excess kurtosis (z-value = 3.42, |kurtosis| = 1.99), which would have been acceptable had the sample size been larger. Box plots identified four outliers, defined by being within 1.5 to 3 times the interquartile range. No extreme outliers (> 3 times the interquartile range) were identified. The four outliers were winsorized to the next highest value. Upon visual inspection of a Q-Q plot, normality then appeared sufficient, which was confirmed with its reduced z-value = 1.42 (|kurtosis| = 1.02). After winsorizing outliers, the social connectedness variable was no longer significantly leptokurtic, and therefore no transformations were necessary

Analyses were also run to assess the psychometric properties of the items on the assessment tools. With the adaptations made in collaboration with our community partner, psychometric properties of scores within all scales retained high internal consistency compared to their original measures: SCS Cronbach’s alpha = .90, FFMQ Cronbach’s alpha = .82, SWLS Cronbach’s alpha = .95, and CPIB Cronbach’s alpha = .92. Descriptive statistics can be viewed in Table 1.

Table 1

Descriptive Statistics for Mindfulness, Social Connectedness, Life Satisfaction, and Communicative Participation Variables Across Study Timepoints

	SCS	FFMQ	SWLS	CPIB
M	4.32	3.70	5.33	2.12
SD	0.95	0.625	1.21	0.70
Skew	-0.642	-0.25	-0.89	0.003
SE of Skew	0.37	0.38	0.39	0.43
Kurtosis	-1.021	-0.65	1.03	-1.74
SE of Kurtosis	0.72	0.74	0.76	0.83

*Note. N*s = 30-42 due to missing data. SCS = Social Connectedness Scale (range = 1-6). FFMQ = Five-Facet Mindfulness Questionnaire (range = 1-5). SWLS = Satisfaction With Life Scale (range = 1-7). CPIB = Communicative Participation Item Bank (range = 0-3).

Bivariate Correlations

Bivariate correlations were run in SPSS with pairwise deletion to reveal the relationships between the outcome variables and time. There was a significant positive relationship between mindfulness and time, (r = .36, p = .03, 95% CI [.14, .45]), in that increases in time were associated with higher levels of mindfulness. No other relationships were significant over time. Due to large proportions of missing data between timepoints 4 and 12, we opted to use three timepoints of each participant. This method was chosen to keep the data longitudinal in nature rather than following a pretest/posttest design with two timepoints. Although the length of time between timepoints varied, correlation patterns remained the same regardless of the number of timepoints used. Thus, results on three timepoints are presented here rather than replacing

missing values across 12 timepoints. Based on pairwise deletion recommendations from Kang (2013) as less biased for data missing at random, analyses were run without other missing data imputation techniques, e.g., Madley-Dawd et al. (2019). These recommendations were followed for all analyses.

Bivariate correlations were also run to assess the relationship among outcome variables themselves. There were significant positive relationships between mindfulness and communicative participation (r = .48, p = .008, 95% CI [.14, .72]), mindfulness and social connectedness (r = .43, p = .009, 95% CI [.12, .66]), and social connectedness and life satisfaction (r = .44, p = .007, 95% CI [.13, .68]). These relationships were significant in the expected direction in that higher levels of mindfulness was associated with higher levels of social connectedness and communicative participation; higher levels of social connectedness was significantly correlated with higher levels of life satisfaction. All other relationships were not statistically significant. See Table 2 for the complete correlation matrix.

Table 2

Bivariate Correlations between Outcome Variables and Time

	(1)	(2)	(3)	(4)	(5)
(1) Time	--				
(2) Social connectedness	.171	--			
(3) Mindfulness	.358*	.426**	--		
(4) Life satisfaction	.124	.444**	.128	--	
(5) Communicative participation	-.016	.184	.483**	.230	--

Note. *N*s = 29-48 due to missing data. **$p < .01$ *$p < .05$

Linear Mixed Models

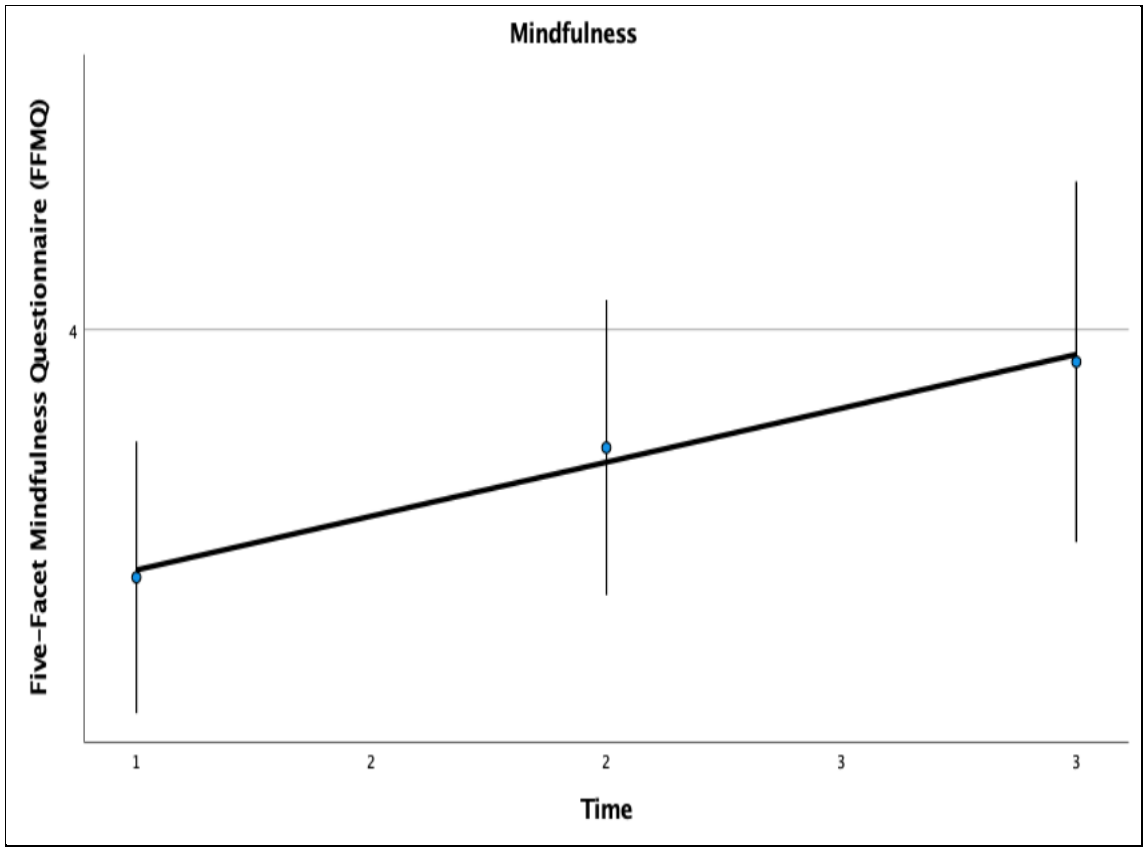
Four linear mixed models for repeated measures were conducted to assess the relationship between time and each of the outcome variables: mindfulness, social connectedness, life satisfaction, and communicative participation. That is, the models examined changes in an outcome variable within an individual and between participants over time. Per best practice conventions, fixed effects estimates are reported, as they represent the most accurate estimate of average effects in the population (Casals et al., 2014). Type III tests of fixed effects were used. Using Akaike's Information Criterion to examine relative model fit, the mindfulness and communicative participation models had better fit than the social connectedness and life satisfaction models, as evidenced by their smaller AIC, 60.68 and 66.43 vs. 116.35 and 119.97, respectively. We computed Cohen's *d* for within-subjects design over Times 1 and 3 per the formula used in G*Power software (Faul et al., 2007, 2009): Cohen's $d = |m_1 - m_2| / \text{sqrt}(s^2_1 + s^2_2 - [2rs_1s_2])$. Determining effect sizes exclusive of sample size and its relation to statistical power seemed appropriate given that the power analysis was not met due to COVID-19 restrictions. Effect size conventions followed Cohen (1992), with effect sizes of ±0.2 indicating a small effect size, ±0.5 indicating a medium effect size, and ±0.8 indicating a large effect size.

Mindfulness

Mindfulness as the dependent variable revealed a significantly positive difference over time ($F[1, 28] = 5.66$, $p = .02$), with a very strong effect size, $d = 2.43$. Estimated marginal means for mindfulness (range = 1-5) at adjusted time points revealed Time 1 $M = 3.52$ ($SE = 0.13$, 95% CI [3.26, 3.78]), Time 2 $M = 3.77$ ($SE = 0.14$, 95% CI [3.49, 4.06]), and Time 3 $M = 3.94$ ($SE = 0.17$, 95% CI [3.59, 4.29]). See Figure 1.

Figure 1

Estimated Marginal Means of Mindfulness Over Time



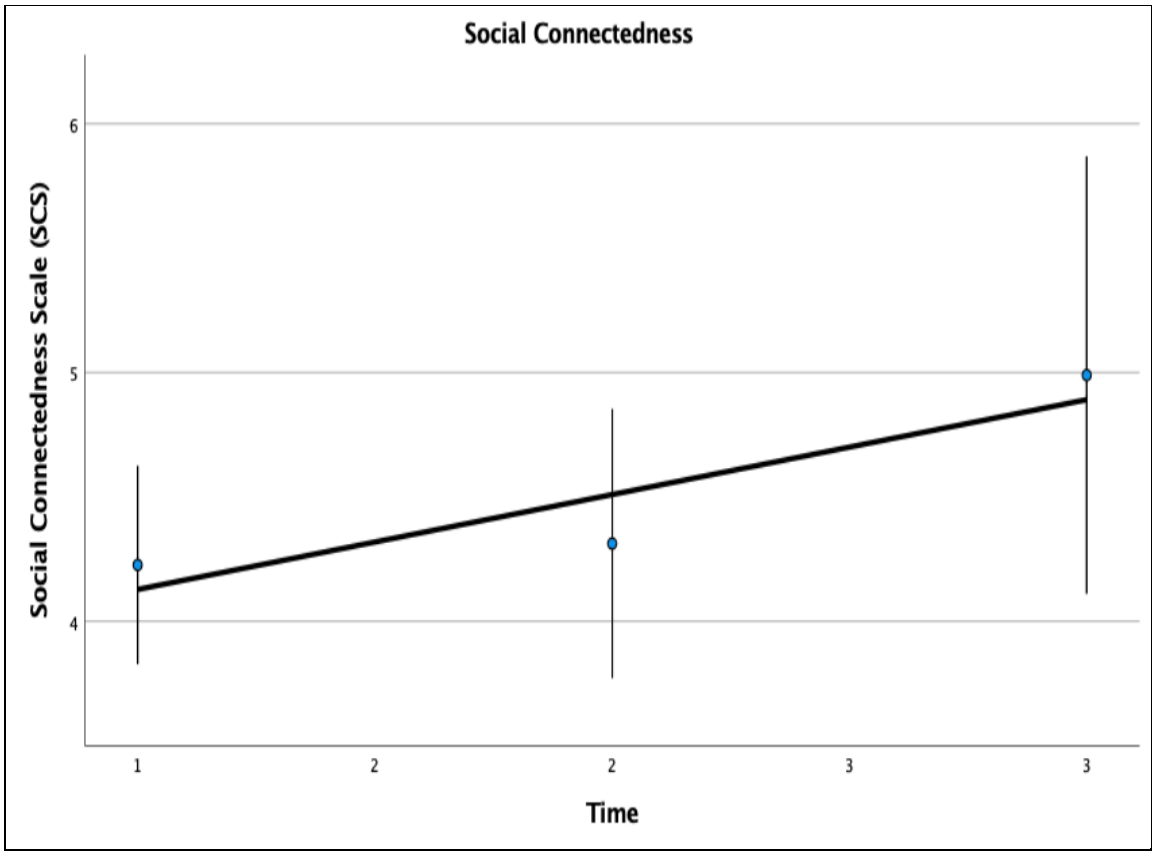
Note. Error bars indicate 95% confidence intervals.

Social Connectedness

The model with social connectedness as the dependent variable indicated no significant difference over time, $F(1, 10) = 1.93$, $p = .19$. Estimated marginal means for social connectedness (range = 1-6) at adjusted time points revealed Time 1 $M = 4.23$ ($SE = 0.19$, 95% CI [3.83, 3.4.63]), Time 2 $M = 4.31$ ($SE = 0.27$, 95% CI [3.77, 4.85]), and Time 3 $M = 4.99$ ($SE = 0.39$, 95% CI [4.11, 5.87]). Although statistically nonsignificant, there was a moderate-large effect in the favorable direction, $d = 0.77$. See Figure 2.

Figure 2

Estimated Marginal Means of Social Connectedness Over Time



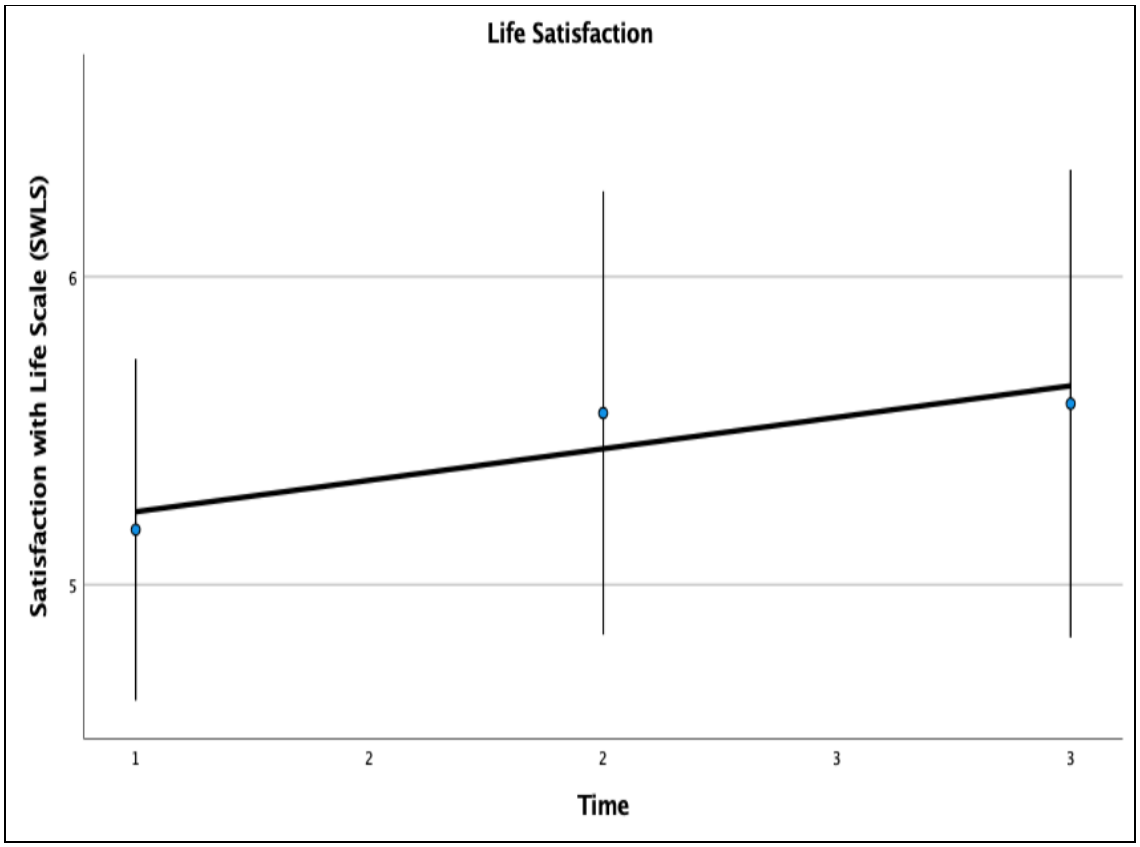
Note. Error bars indicate 95% confidence intervals.

Life Satisfaction

Similar to the model with social connectedness, the model with life satisfaction as the dependent variable also indicated no statistically significant difference over time, $F(1, 11) = 1.48$, $p = .27$. Estimated marginal means for life satisfaction (range = 1-7) at adjusted time points revealed Time 1 $M = 5.18$ ($SE = 0.27$, 95% CI [4.62, 5.73]), Time 2 $M = 5.56$ ($SE = 0.35$, 95% CI [4.84, 6.28]), and Time 3 $M = 5.59$ ($SE = 0.36$, 95% CI [4.83, 6.35]). Although statistically nonsignificant, there was a large effect in the favorable direction, $d = 0.92$. See Figure 3.

Figure 3

Estimated Marginal Means of Life Satisfaction Over Time



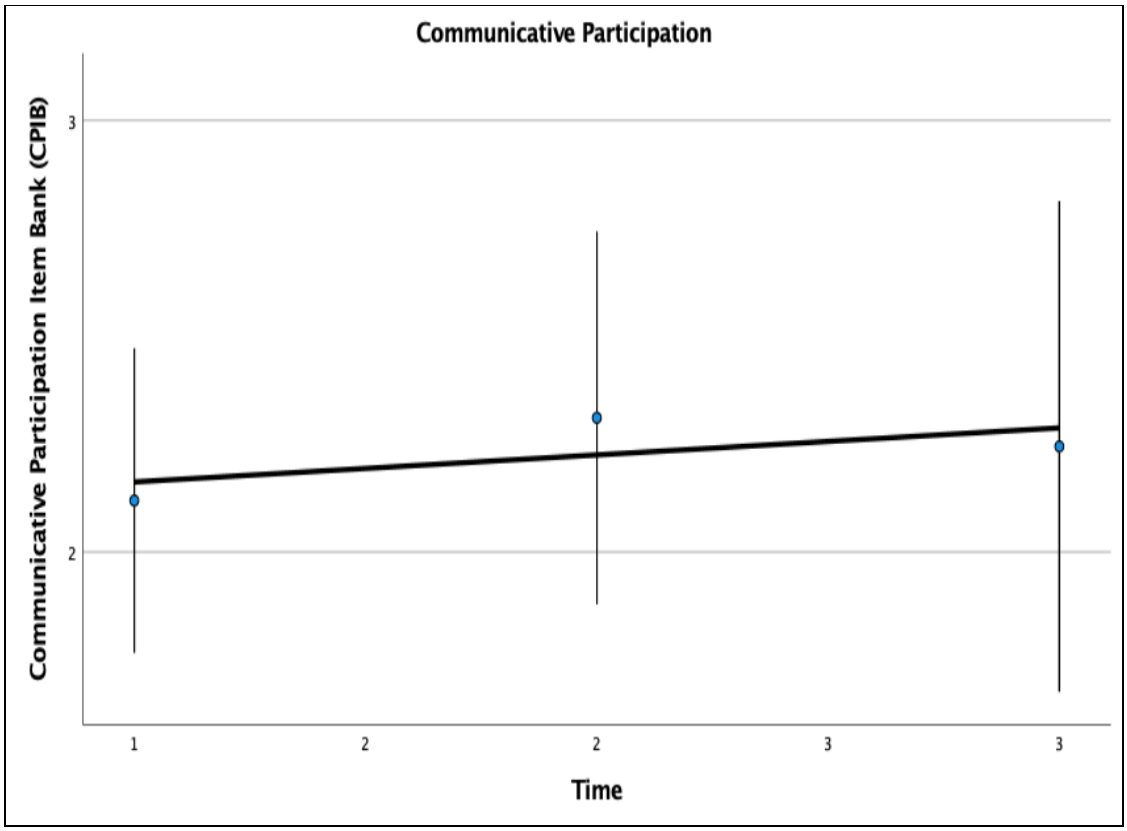
Note. Error bars indicate 95% confidence intervals.

Communicative Participation

The model with communicative participation as the dependent variable indicated no statistically significant difference over time, $F(1, 13) = 0.40$, $p = .68$. Estimated marginal means for communicative participation (range = 0-3) at adjusted time points revealed Time 1 $M = 2.12$ ($SE = 0.17$, 95% CI [1.77, 2.47]), Time 2 $M = 2.31$ ($SE = 0.21$, 95% CI [1.88, 2.74]) , and Time 3 $M = 2.25$ ($SE = 0.28$, 95% CI [1.68, 2.8]). Although statistically nonsignificant, there was a small-moderate effect in the favorable direction, $d = 0.40$. See Figure 4.

Figure 4

Estimated Marginal Means of Communicative Participation Over Time



Note. Error bars indicate 95% confidence intervals.

Qualitative Feedback

Two questions (Guarino et al., 2016) were included in the survey tool to allow participants to make comments and suggest improvements. Table 3 shows the responses given for each question listed. A general theme emerged suggesting that participants enjoyed the sessions and felt more relaxed or calmer after yoga sessions. Another theme consisted of difficulties related to the COVID-19 pandemic, such as missing or not receiving the socialization portion that occurs with in-person sessions and that the session(s) moved at a slower pace than what was preferred. Suggestions for improvement included offering more sessions, offering different levels of difficulty, moving the session along faster, including introductions and time for socializing, and recording or taping the sessions.

Table 3

Responses to Qualitative Feedback Questions

"What are your general comments on the session, if any?"	"What are your suggestions for improvement, if any?"
"She feels more relaxed after each session, and is starting to speak out a little more than normal"	"Offer more yoga with [instructor]. She is amazing! Add more offerings of Yoga and exercise or taped sessions."
"I really enjoy the sessions. The Virtual Yoga is more of an instructor-based class, so we don't socialize with the others in the class, but it is nice to see the same familiar faces each week even if we don't fully know each other."	"Have different levels, such as beginner, intermediate, advanced to choose from."
"I have had a lot of stress in my life over the past few weeks and I look forward to yoga sessions to focus on relaxing"	"Could move a little faster."
"When the pandemic wanes my answers will be quite different!"	"Maybe some time for introductions of the participants might be nice before each

	class, just so we get a little bit more of that connection with the class participants"
"We LOVE yoga and doing it with so many fun people!"	"Record it so that we can pull it up later that day."
"When doing yoga I am able to concentrate fully on my mind and body and block everything else out"	
"I appreciate the opportunity to zoom the adapted yoga class"	
"I feel so calm and relaxed after each session and even my Mom who sits in the other room says she feels calm listening to the instructor speak"	
"Some of my answers are skewed because of coronavirus restrictions. I appreciate the virtual opportunity to participate"	
"The yoga sessions didn't have me thinking or feeling distressed or incapable or more capable. I'm finding the yoga sessions to be on a slower pace for me. It seems geared for older, or less mobile, people than I am. I'm a quad amputee, but I have prosthetic legs to walk with and move more than the sessions are geared for. I'll try another one, but may not continue if the sessions remain too basic."	
"I look forward to the yoga sessions that I can attend. It makes me feel calmer."	
"Love it. Wish there were more"	

Discussion

Previous research has shown that adaptive yoga and sports programs may have a positive impact on psychological, mental, and social domains in individuals with disabilities. The purpose of this community-based participatory research study was to assess the feasibility of using an assessment tool with a community adaptive yoga and sports program institute and to assess outcomes of mindfulness, life satisfaction, social connectedness, and communicative participation over time in individuals with disabilities. In the present study, all of the participants who completed the assessment tool participated in virtual adaptive yoga. That is, no participant reported engaging in another sports and recreation program without also engaging in yoga that week. This made it impossible to assess our third research objective of comparing other programs to yoga programs in an accurate way considering everyone engaged in yoga and only seven participants engaged in other programs.

Nonetheless, the first research objective was to assess the feasibility of co-developing and using an assessment tool in a community program with individuals who have a variety of disabilities. We successfully collaborated with the community-based rehabilitation institute to co-create a weekly assessment that was perceived to meet the needs of their clients. Internal consistency on the assessments administered was maintained alongside adaptations and empirically-based selection of items used from the scales. This shows that the assessment, administered at a 6th grade reading level, may be a useful tool for community organizations who wish to measure these outcomes in a brief and culturally-sensitive manner for individuals with disabilities.

However, changes to the programs (e.g., no availability of paper copies for those with mobility issues or resource limitations for the online-administered assessments, absence of volunteer assistants to help with ratings) made it difficult to assess accurately the frequency of use for the assessment tool. The sample size was small, and few participants completed the assessment tool consistently each week. This suggests that perhaps weekly assessment may be overwhelming or not perceived as useful to the participants. The addition of an incentive or the switch to a pretest/posttest design may enhance the costs-benefits regarding feasibility of administering the survey tool.

The second objective was to assess the primary outcome variable of mindfulness and the secondary outcome variables of social connectedness, life satisfaction, and communicative participation over time. The results were mixed, with a statistically significant increase only in mindfulness over time. All secondary outcomes did not result in a statistically significant change in relation to time, but effect sizes appeared promising in the hypothesized direction. Given that all participants took part in the adaptive yoga program in some way, it is understandable that mindfulness had the greatest increase over time relative to other outcome variables. This is especially true considering the strong direct relationship between mindfulness and yoga practice (Combs et al., 2018; Garrett et al., 2011; Singh & Hwang, 2020).

Although effect sizes were small-moderate to large for the secondary outcomes (social connectedness, life satisfaction, communicative participation), none of these models were statistically significant. This may be due in part to low statistical power coupled with higher variability in scores over time, likely as a function of missing data.

These results may also reflect a lack of an effect in the real world, as transitioning from in-person to virtual programs likely reduced the level of social interaction that participants had with each other, the instructors, and other volunteers. This is supported by some of the qualitative feedback that participants reported, such as “Maybe some time for introductions of the participants might be nice before each class, just so we get a little bit more of that connection with the class participants”; “I really enjoy the sessions. Virtual Yoga is more of an instructor-based class, so we don't socialize with the others in the class, but it is nice to see the same familiar faces each week even if we don't fully know each other”; and “When the pandemic wanes my answers will be quite different!”

Given that social connectedness had nonsignificant changes over time, it follows that life satisfaction did as well since there was a moderate-large effect size and significant relationship between life satisfaction and social connectedness (r = .44). This may suggest, particularly for life satisfaction and social connectedness, that perhaps the programs are not directly targeting these variables, with extraneous variables such as COVID-19 playing a role in the results. However, interestingly, the statistically significant moderate-large effect size of the relationships between mindfulness and social connectedness (r = .43) as well as communicative participation (r = .48) did not translate to changes in social connectedness over time.

Limitations

These study results need to be taken in light of its limitations, which can often occur in community-based, field settings in which it is more difficult to maintain control. The sample size was relatively small, and there were multiple missing data points due to

inconsistencies in self-reporting. This made it difficult to get an accurate estimate of progress over time. Both smaller sample sizes and missing data can reduce the power of a study. It is important to mention that data collection took place during the global COVID-19 pandemic that began in March 2020. Changes to the programs included a shift to almost purely virtual sessions without in-person assistance of volunteer support staff. This limited the sample to participants who had access to and capacity to complete an online assessment. This also made it more difficult to ensure consistency in completion of the surveys. Changes to the tool included movement to a purely online assessment tool (vs. paper copies and in-person writing assistance) and loss of input from volunteer support staff as third-party raters. Virtual sessions may not have tapped into some of the outcome measures as well as in-person sessions might, particularly social connectedness.

Conclusions

While results are limited due to changes that were necessary for this study to continue during a global pandemic, the present study also provides valuable information regarding wellbeing programs for an underserved group. The data uniquely comprise a snapshot in time when individuals with disabilities were forced to disengage from in-person socialization. Thus, although there was not an inert comparison group, it is meaningful that there were not statistically significant *decreases* in social connectedness, life satisfaction, and communicative participation over time in the present sample during COVID-19 in particular. Perhaps even more importantly, mindfulness was found to increase over time despite the challenges concurring with the pandemic. Additionally,

although there are limitations regarding control with community-based interventions, they provide the opportunity to assess available effectiveness and generalizability, extending previous lab-based research into a community program. Although there is still much research to be conducted in this area, this study provides a step forward in conducting strengths-based, effectiveness research for an underserved population.

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Appendix: Measures

All questions are voluntary, and you can choose "I decline to answer" if you do not wish to respond to an item.

Mindfulness

Adapted from Bohlmeijer et al. (2011)

Indicate how often you have had each experience *since you participated in the session.*

Never or rarely true	Not often true	Sometimes true, sometimes not true	Often true	Very often or always true
1	2	3	4	5

Since I've participated in the session… I was good at finding the words to describe my feelings

Since I've participated in the session… I watched my feelings without getting carried away by them

Since I've participated in the session… I told myself that I can feel however I am feeling

Since I've participated in the session… It was easy for me to find the words to describe what I was thinking

*Since I've participated in the session…*I made judgments about whether my thoughts were good or bad

Since I've participated in the session… When I had distressing thoughts or images, I did not let myself be carried away by them

Since I've participated in the session… When I felt something in my body, it was easy for me to find the right words to describe it

Since I've participated in the session… It seems I have been "running on automatic" with much awareness of what I was doing

Since I've participated in the session… When I had distressing thoughts or images, I felt calm soon after

Since I've participated in the session… I told myself I should not be thinking the way I was thinking

Since I've participated in the session… When I had distressing thoughts or images, I just noticed them and let them go

Since I've participated in the session… I found myself doing things without paying attention

Social Connectedness

Adapted from Lee et al. (2001)

Indicate how much you agree or disagree with each statement *since you participated in the session.*

Strongly Disagree	Disagree	Mildly Disagree	Mildly Agree	Agree	Strongly Agree
1	2	3	4	5	6

Since I've participated in the session… I felt close to people

Since I've participated in the session… I was able to relate to my peers

Since I've participated in the session… I was able to connect with other people

Life Satisfaction

Adapted from Diener et al. (1985)

Indicate how much you agree or disagree with each statement *since you participated in the session.*

Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree

1 2 3 4 5 6 7

Since I've participated in the session… In most ways my life has been close to my ideal

Since I've participated in the session… The conditions of my life have been excellent

Since I've participated in the session… I have been satisfied with my life

Since I've participated in the session… I have gotten the important things I want in life

Since I've participated in the session… I would change almost nothing

Communicative Participation

Adapted from Baylor et al. (2013)

Please indicate how much you feel each question is true for you *since you participated in the session.*

Not at all A little Quite a Bit Very Much

0 1 2 3

Since you've participated in the session, were you able to… talk with people you know?

Since you've participated in the session, were you able to… communicate when you needed to say something quickly?

Since you've participated in the session, were you able to… talk with people you do NOT know?

Since you've participated in the session, were you able to… communicate when you were out in your community (e.g., errands, appointments)?

Since you've participated in the session, were you able to… ask questions in a conversation?

Since you've participated in the session, were you able to… communicate in a small group of people?

Since you've participated in the session, were you able to… have a long conversation with someone you knew about a book, movie, show, or sports event?

Since you've participated in the session, were you able to… give someone DETAILED information?

Since you've participated in the session, were you able to… get your turn in a fast-moving conversation?

Since you've participated in the session, were you able to… try to persuade a friend or family member to see a different point of view?

Qualitative Feedback

Adapted from Guarino et al. (2016)

What are your general comments on the session?

What are your suggestions for improvement, if any?